



Biologic width and Restorative Interrelationships

Dr Amin Rajabzadeh

Margin Placement and Biologic Width

- ▶ role of biologic width in preserving healthy gingival tissues and controlling the gingival form around restorations.
- ▶ The placement of a restoration margin seems to be of importance for periodontal health (Kois 1996, Amiri-Jezeh et al. 2006).

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PERIODONTOLOGY 2000
ISSN 0906-6713*

The restorative-periodontal interface: biological parameters

JOHN C. KOIS


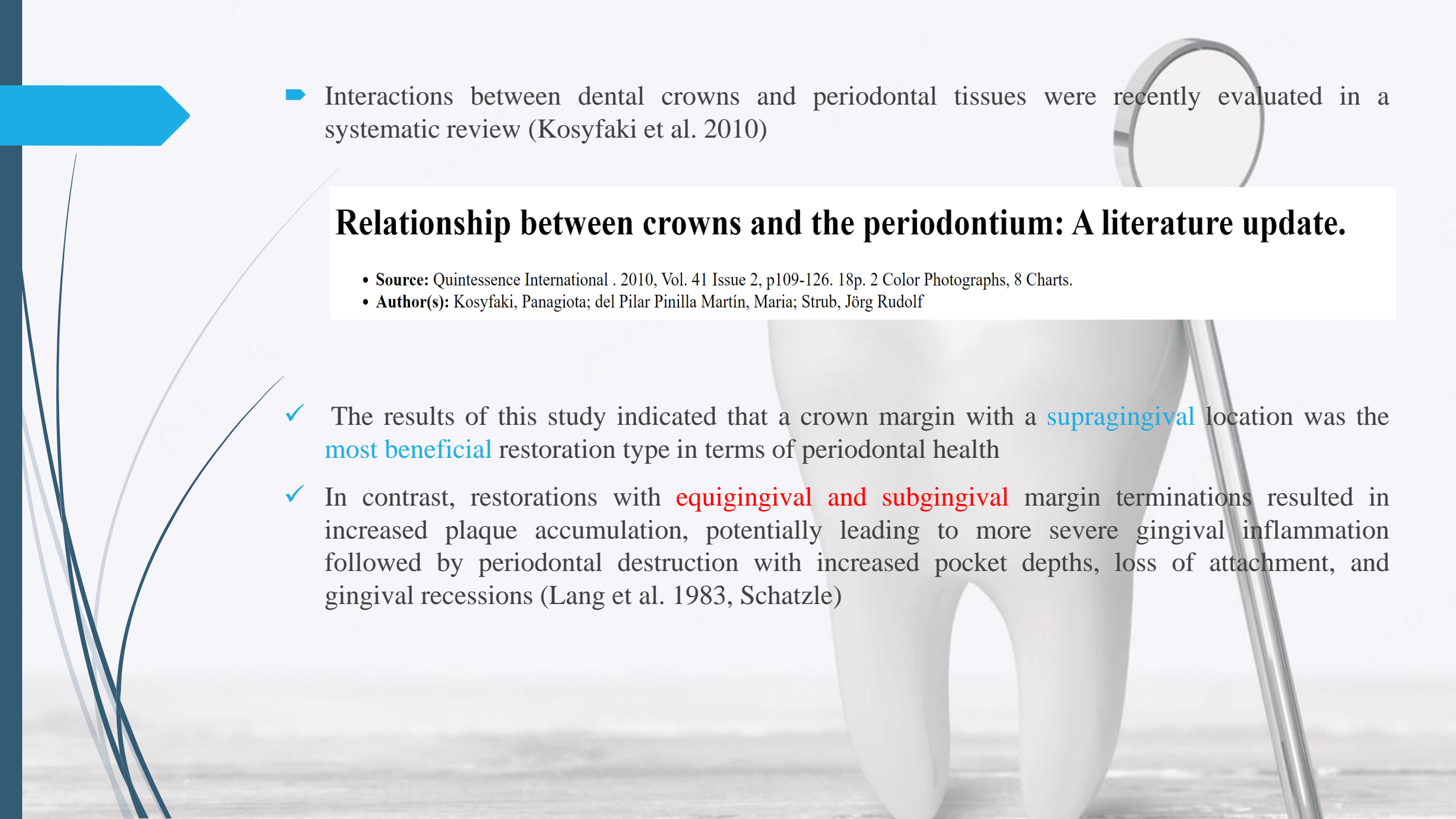
- ▶ In addition to the influence of several risk factors (Kinane et al. 2006), the position of the restoration margin may affect the initiation and progression of periodontal diseases (Matthews and Tabesh 2004)

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Detection of localized tooth-related factors that predispose to periodontal infections

DEBORA C. MATTHEWS & MOE TABESH

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- Interactions between dental crowns and periodontal tissues were recently evaluated in a systematic review (Kosyfaki et al. 2010)

Relationship between crowns and the periodontium: A literature update.

- **Source:** Quintessence International . 2010, Vol. 41 Issue 2, p109-126. 18p. 2 Color Photographs, 8 Charts.
- **Author(s):** Kosyfaki, Panagiota; del Pilar Pinilla Martín, Maria; Strub, Jörg Rudolf

- ✓ The results of this study indicated that a crown margin with a **supragingival** location was the **most beneficial** restoration type in terms of periodontal health
- ✓ In contrast, restorations with **equigingival and subgingival** margin terminations resulted in increased plaque accumulation, potentially leading to more severe gingival inflammation followed by periodontal destruction with increased pocket depths, loss of attachment, and gingival recessions (Lang et al. 1983, Schatzle)



Supragingival Margin

- It has the **lowest impact** on the periodontium.
- Its position has been applied in unesthetic areas due to the considerable contrast in color and opacity of conventional restorative materials against the tooth. With the arrival of more translucent restorative materials and resin cements, the ability to place supragingival margins in esthetic areas is now possible

A Review On Biologic Width: The Key To Restorative And Periodontal Interrelationships

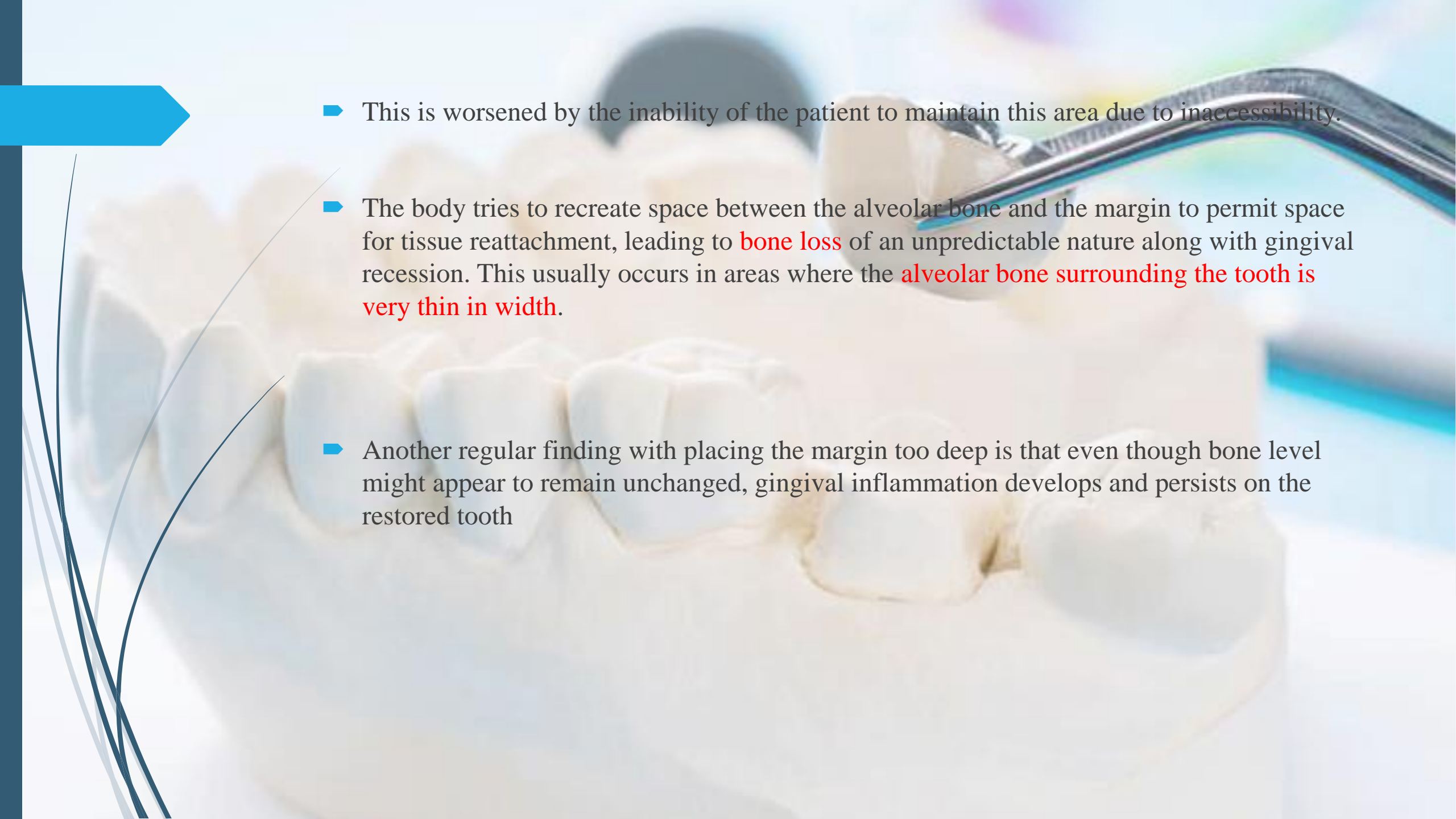
Saathvika Ramani, *VijayalakshmiRajaram, C. Burnice NalinaKumari, *Jaideep Mahendra,Ambalavanan Namasivayam

Equigingival Margin

- Conventionally, the use of equigingival margins was not desirable because they were thought to favour more plaque accumulation than supragingival or subgingival margins, and thus result in greater gingival inflammation.
- Another concern was that any minor gingival recession could create an unsightly margin display.
- These concerns are not valid today, not only because the restoration margins can be esthetically merged with the tooth but also because restorations can be finished easily, giving a smooth, polished interface at the gingival margin.
- From a periodontal viewpoint, **both supragingival and equigingival margins are well endured**

Subgingival Margin

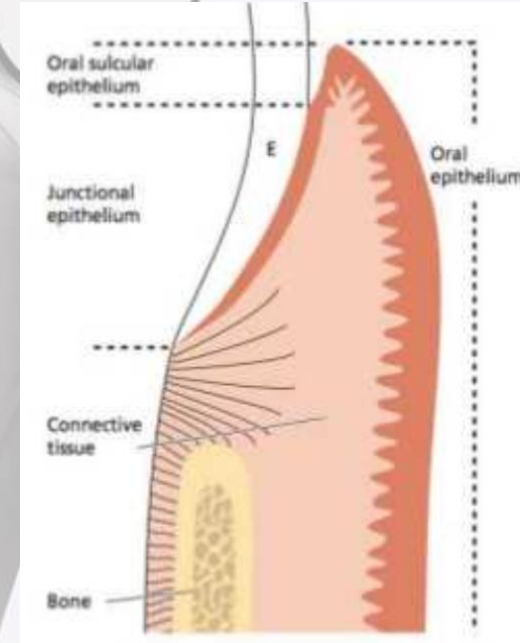
- ▶ The **greatest risk** occurs here. These margins are not as reachable as supragingival or equigingival margins for finishing procedures. Moreover, if the margin is placed too far below the gingival tissue crest, it will breach the gingival attachment.
- ▶ Restorative considerations may often warrant that the margins be positioned below the gingival tissue crest owing to caries or tooth deficiencies, and/or to conceal the tooth/restoration interface.
- ▶ Infringement into biologic periodontal space for additional retention will lead to iatrogenic periodontal disease along with premature loss of the restoration. Positioning of restorative margin within the biologic width is deleterious to the health of the periodontium as it acts as a plaque retentive factor.
- ▶ When the restoration margin is positioned too far below the gingival tissue crest, it will encroach on the gingival attachment apparatus and results in a constant inflammation.

- 
- This is worsened by the inability of the patient to maintain this area due to inaccessibility.
 - The body tries to recreate space between the alveolar bone and the margin to permit space for tissue reattachment, leading to **bone loss** of an unpredictable nature along with gingival recession. This usually occurs in areas where the **alveolar bone surrounding the tooth is very thin in width.**
 - Another regular finding with placing the margin too deep is that even though bone level might appear to remain unchanged, gingival inflammation develops and persists on the restored tooth

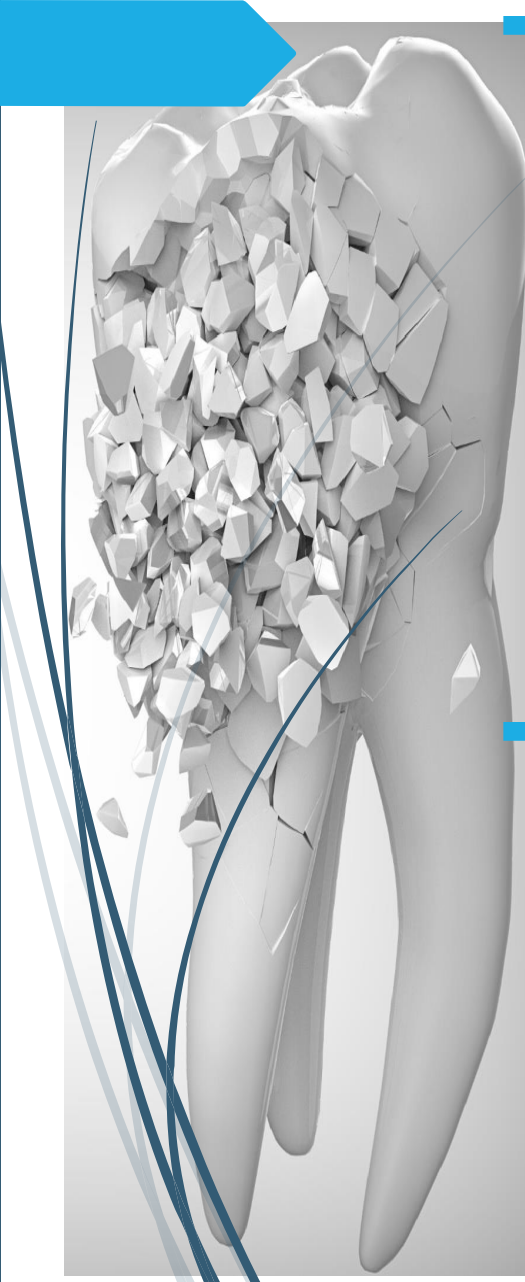
➤ These inflammatory processes seem to be associated with a breach of the **biologic width**

➤ The **dentogingival complex** comprises three definitive components:

1. the connective tissue fibrous attachment
2. the junctional epithelium
3. the gingival sulcus or periodontal pocket



➤ The **biologic width** is defined as the junctional epithelium and supracrestal connective tissue attachment – **without** the depth of the gingival sulcus – surrounding every tooth



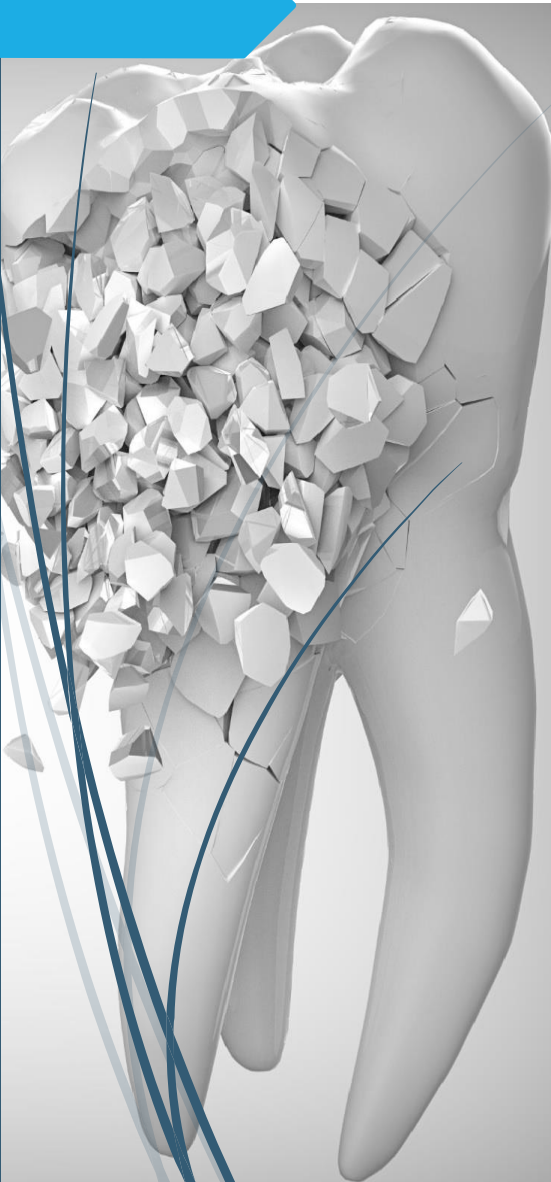
➤ The suggested [physiological function of the biologic](#) width is that of a protective barrier for the subjacent periodontal ligament and the supporting alveolar bone (Bosshardt & Lang 2005).

The Junctional Epithelium: from Health to Disease

[D.D. Bosshardt*](#), [N.P. Lang](#)

First Published January 1, 2005 | Other | [Find in PubMed](#)

➤ This complex protects the subjacent periodontal ligament and the alveolar bone from the attack of a pathogenic biofilm present in the oral cavity (Bosshardt & Lang 2005).



- Evidence from different types of studies and a recent review suggests that a breach of the biologic width have an impact on periodontal health (Newcomb 1974, Tal et al. 1989, Padbury et al. 2003).
- The importance of the biologic width in relation to gingival health and as a guide for placing dental restorations has been studied. Clinically, Newcomb found that the greatest degree of gingival inflammation was seen when subgingival crown margins were placed near the base of the gingival crevice

The Relationship Between the Location of Subgingival Crown Margins and Gingival Inflammation

by

GUY M. NEWCOMB, B.D.S., M.SC.

Journal of Clinical
Periodontology

EFP
Official scientific Journal of the European Federation
of Periodontology and its member National Societies

Periodontal response to long-term abuse of the gingival
attachment by supracrestal amalgam restorations

Haim Tal, Michael Soldinger, Areyh Dreiangel, Sandu Pitaru

First published: November 1989 | <https://doi.org/10.1111/j.1600-051X.1989.tb01035.x> | Citations: 31

Journal of Clinical
Periodontology

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Interactions between the gingiva and the margin of restorations

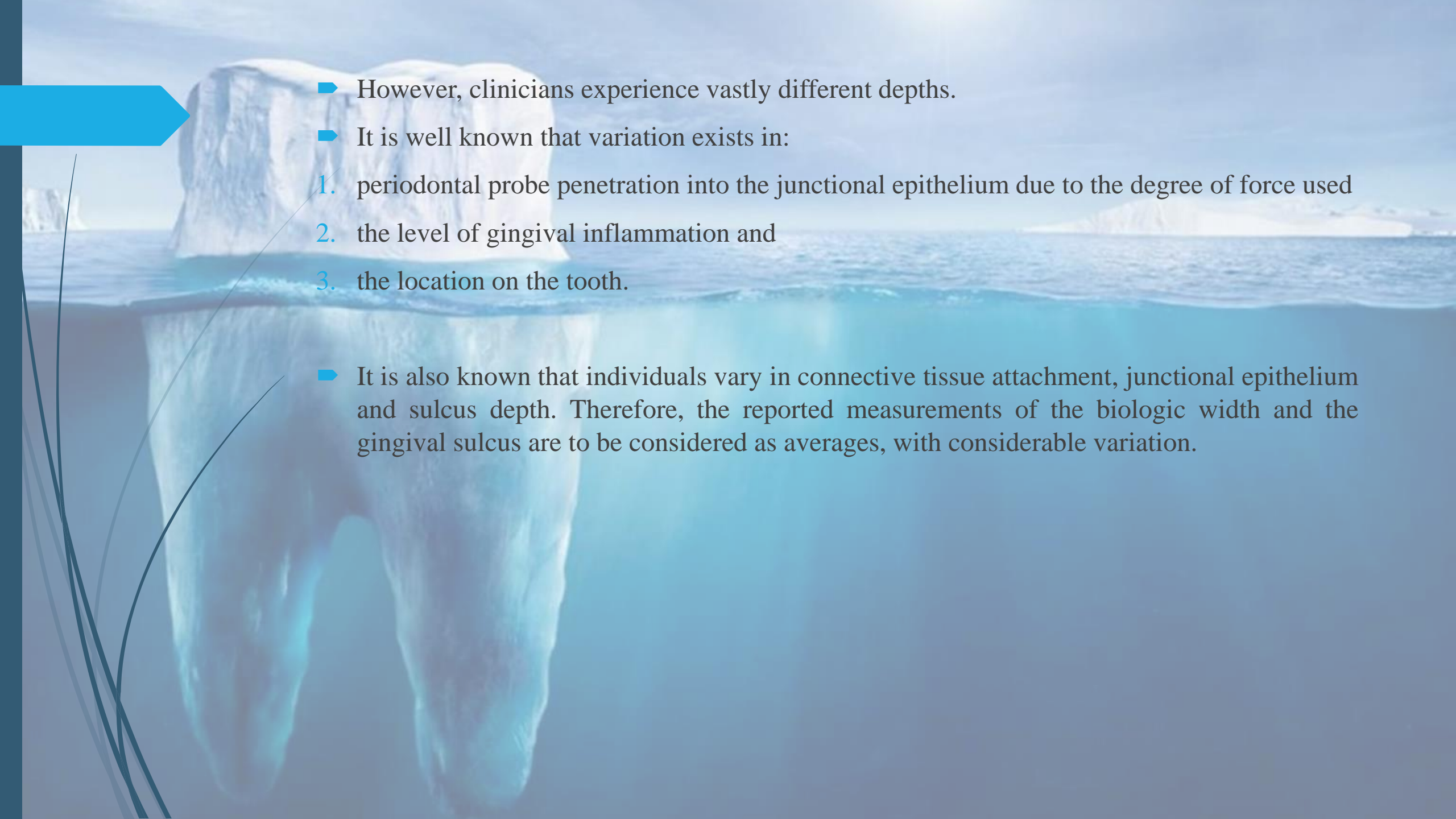
Allan Padbury Jr, Robert Eber, Hom-Lay Wang

First published: 25 April 2003 | <https://doi.org/10.1034/j.1600-051X.2003.01277.x> | Citations: 103



REVIEW

- ▶ The effect of the location of an artificial crown margin on plaque accumulation and gingival health is well documented . A margin location apical to the gingival tissue tends to adversely affect gingival health.
- ▶ The most critical factor in margin location seems to be the relationship to the supracrestal fiber attachment
- ▶ A margin placed apical to the base of the periodontal pocket into the zone of biological width, specifically, into connective tissue attachment, violates important biological principles with adverse consequences for long-term gingival health. Therefore, the most important consideration for intracrevicular restorative dentistry is locating the base of the gingival sulcus or periodontal pocket

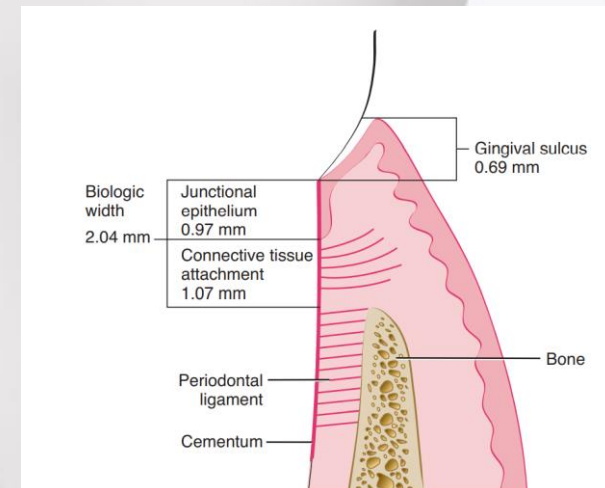
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- The background of the slide is a photograph of an iceberg in the ocean. The tip of the iceberg, which is visible above the water, represents the small portion of clinical data that is easily measurable. The much larger portion of the iceberg, which is submerged below the water, represents the vast, often unmeasured or unexplored depths of clinical variation and individual differences. A blue arrow on the left points towards the text, and several thin, curved lines are visible in the bottom left corner.
- However, clinicians experience vastly different depths.
 - It is well known that variation exists in:
 1. periodontal probe penetration into the junctional epithelium due to the degree of force used
 2. the level of gingival inflammation and
 3. the location on the tooth.
 - It is also known that individuals vary in connective tissue attachment, junctional epithelium and sulcus depth. Therefore, the reported measurements of the biologic width and the gingival sulcus are to be considered as averages, with considerable variation.

- Gargiulo et al. found a vertical measurement of 2.04 mm for biological width.

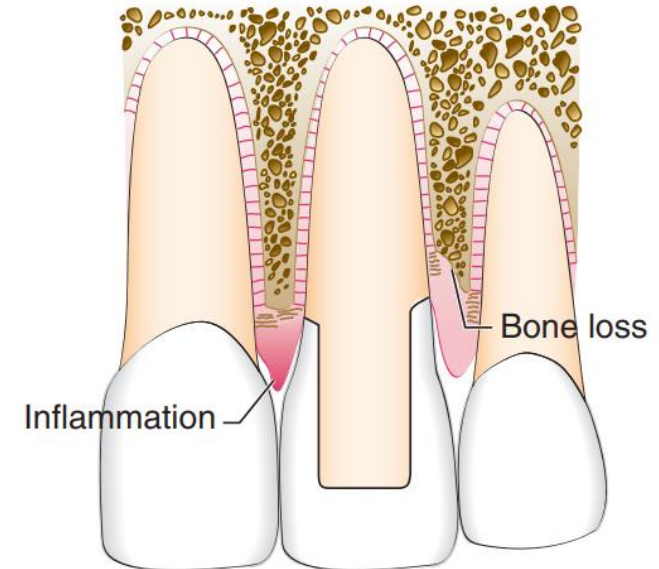
Mitotic activity of human oral epithelium exposed to 30 per cent hydrogen peroxide ☆

Anthony W. Gargiulo D.D.S., M.S.^{1,2}, Frank M. Wentz D.D.S., Ph.D.^{1,2}, Balint Orban^{1,2,†}

- connective tissue attachment occupies 1.07 mm and junctional epithelial attachment occupies 0.97
- Clinically, this information is applied to diagnose biologic width violations when the restoration margin is placed 2 mm or less away from the alveolar bone and the gingival tissues are inflamed with no other etiologic factors evident.



- When the restoration margin is placed too far below the gingival tissue crest, it impinges on the gingival attachment apparatus and creates a violation of biologic width:
- 1: One possibility is that bone loss of an unpredictable nature and gingival tissue recession occurs.
- 2: more common finding with deep margin placement is that the bone level appears to remain unchanged, but gingival inflammation develops and persists.
- surgery to alter the bone level or by orthodontic extrusion.



Biologic Width Evaluation

- ▶ histological
- ▶ Radiographic
- ▶ periodontal probe: discomfort, bone sounding.
- ❖ In 1994 Vacek and colleagues also investigated the biologic width phenomenon. Although their average width finding of 2 mm was the same as that previously presented by Gargiulo and associates, they also reported a range of different biologic widths that were **patient specific**. They reported biologic widths as narrow as **0.75** mm in some individuals, whereas others had biologic widths as tall as **4.3** mm.

The Dimensions of the Human Dentogingival Junction



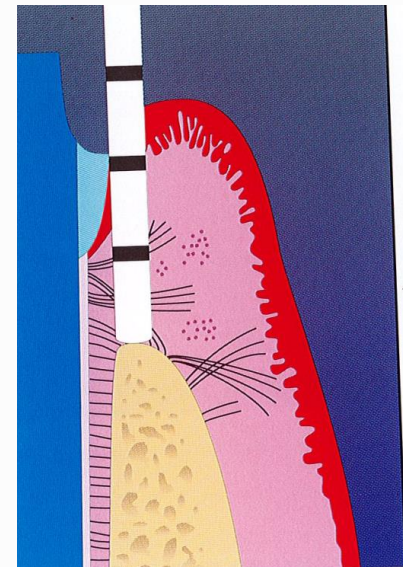
James S. Vacek, DDS*
Marlin E. Gher, DDS, MEd*
Daniel A. Assad, DDS*
A. Charles Richardson, DDS*
Leo I. Giambaresi, PhD*

- Qualitative and quantitative discrimination between the junctional epithelium and connective tissue attachment is possible by histological methods, with the caveat that the laboratory preparation may introduce artifacts into the specimens. **The application of a histological method is often precluded in a clinical situation for ethical reasons**
- Different clinical methods, including the measurement of the gingival margin and the attachment level by periodontal probing and the evaluation of the alveolar bone level by **transgingival probing**, were employed (Lanning et al. 2003, Al-Rasheed et al. 2005, Shobha et al. 2010, Galgali & Gontiya 2011, Ganji et al. 2012).
- Transgingival probing following the administration of local anesthesia seems to be an accurate and reliable method for estimating the alveolar bone level and to detect osseous defects (Greenberg et al. 1976, Ursell 1989, Mealey et al. 1994, Perez et al. 2007).

Transgingival probing as a potential estimator of alveolar bone level.

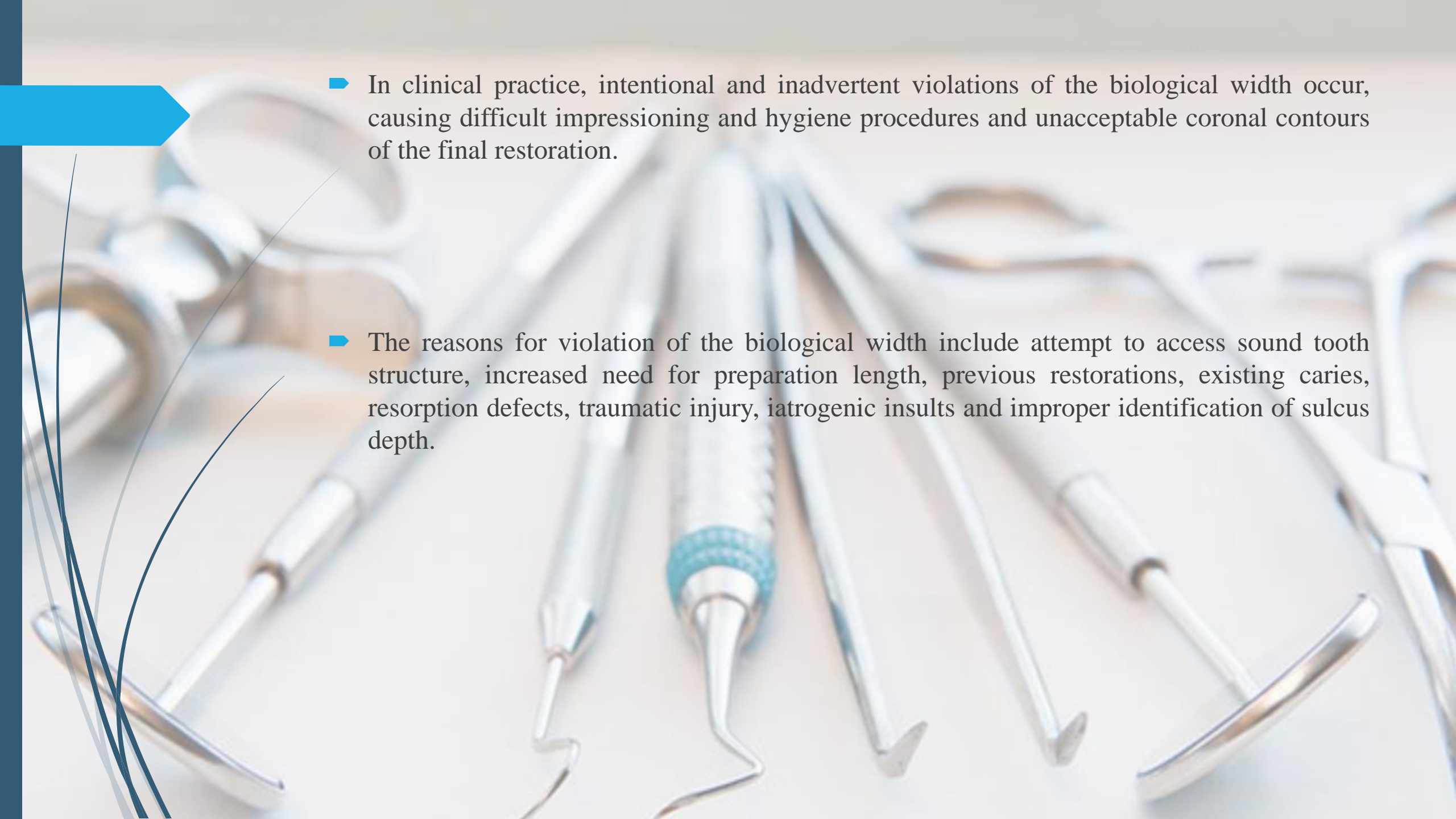
Greenberg J, Laster L, Listgarten MA

Journal of Periodontology, 01 Sep 1976, 47(9):514-517





Evaluation of biologic width violation

- 
- In clinical practice, intentional and inadvertent violations of the biological width occur, causing difficult impressioning and hygiene procedures and unacceptable coronal contours of the final restoration.
 - The reasons for violation of the biological width include attempt to access sound tooth structure, increased need for preparation length, previous restorations, existing caries, resorption defects, traumatic injury, iatrogenic insults and improper identification of sulcus depth.



Clinical Method

- ▶ If a patient feels tissue discomfort when the restoration margin levels are being evaluated with a periodontal probe, it is a reliable indicator that the margin extends into the attachment and that a biologic width violation has occurred.
- ▶ The signs of biologic width violation are: Chronic progressive gingival inflammation around the restoration, bleeding on probing, localized gingival hyperplasia with minimal bone loss, gingival recession, pocket formation, clinical attachment loss and alveolar bone loss.



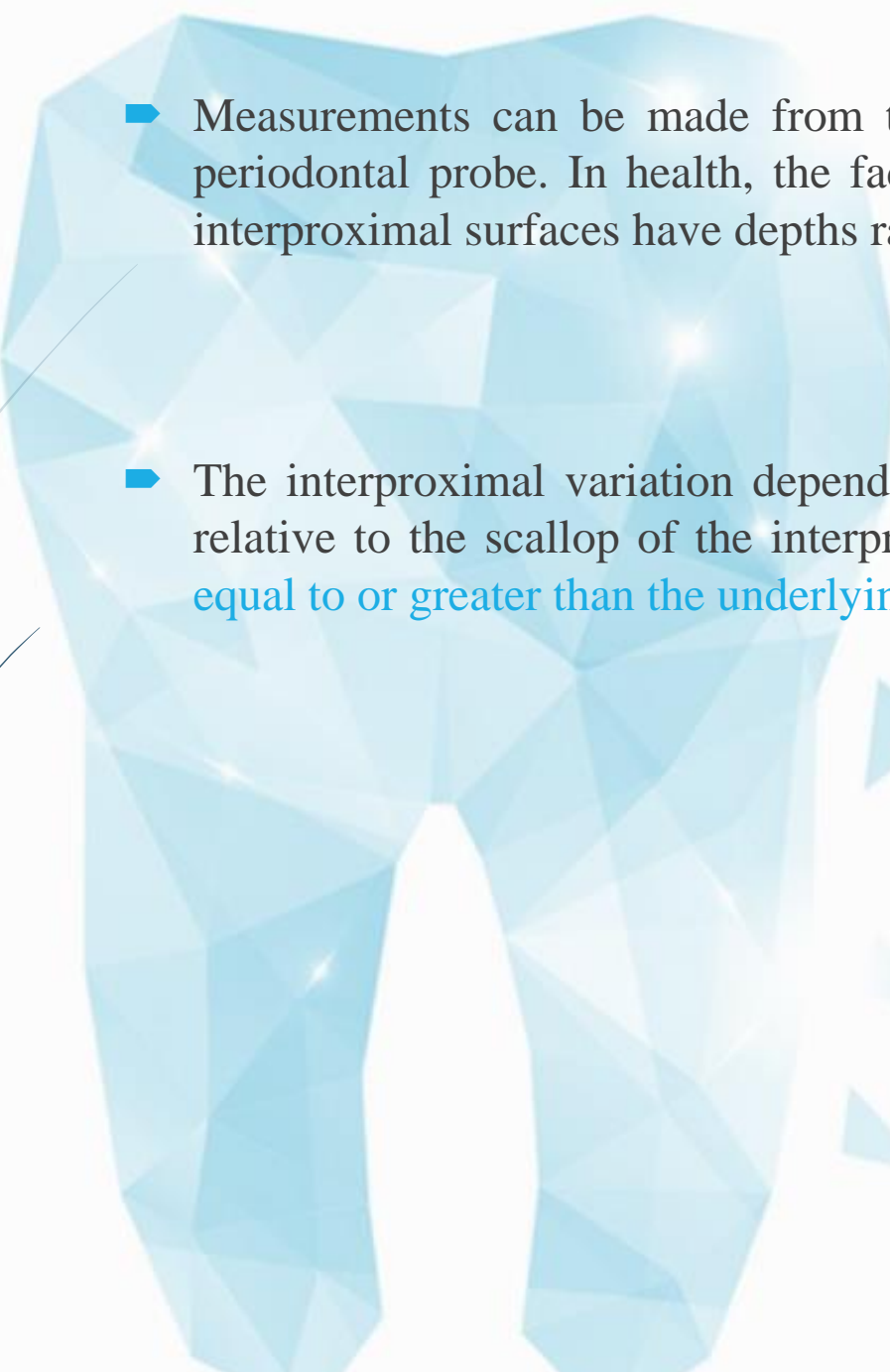
Bone Sounding

- ▶ The periodontal probe is used for determining biological width. Under local anesthesia, the biological width can be established by probing to the bone level (referred to as 'sounding to the bone') and subtracting the sulcus depth from the derived measurement. If this distance is less than 2 mm at one or more locations, a diagnosis of biological width violation can be confirmed.

The background of the slide features a light blue and white aesthetic. On the left, there is a solid blue arrow pointing to the right. The background is decorated with several faint, overlapping dental radiographs (X-rays) of teeth. In the upper right corner, a portion of a dental mirror is visible, showing its circular head and handle. Thin, dark blue curved lines are also present on the left side of the slide.

Radiographic Evaluation

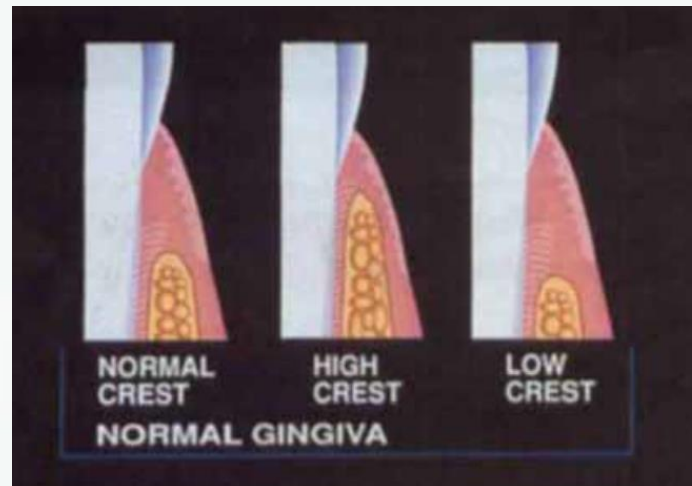
- ▶ Radiographically, interproximal violations of biologic width can be determined. Nonetheless, on the mesiofacial and distofacial line angles of teeth, radiographs aren't diagnostic owing to tooth superimposition.

- 
- A large, stylized graphic of a tooth in shades of blue, composed of many small triangles, serving as a background for the text.
- Measurements can be made from the free gingival margin to the osseous crest with a periodontal probe. In health, the facial aspect has approximately a 3-mm depth, and the interproximal surfaces have depths ranging from 3 to 4.5 mm.
 - The interproximal variation depends on the amount of the scallop of the gingival tissue relative to the scallop of the interproximal alveolar bone. The gingival scallop is always equal to or greater than the underlying osseous scallop

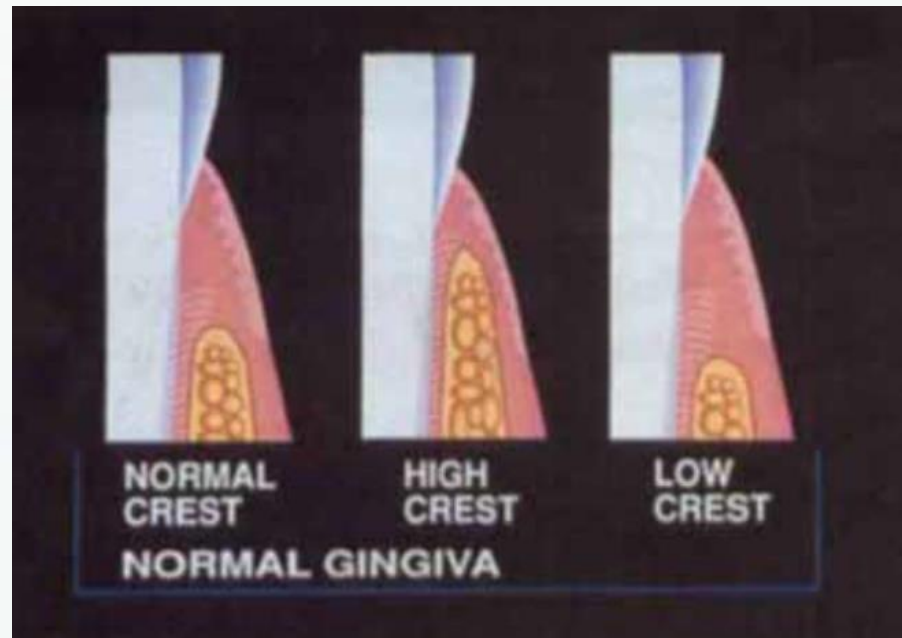
- ▶ The osseous scallop parallels the cementoenamel junction circumferentially. The osseous scallop is thus **greatest for the maxillary anterior teeth and flattens out posteriorly**
- ▶ The biological width follows the osseous scallop. Therefore, the inappropriate use of a more horizontal tooth preparation margin as opposed to a scalloped margin on anterior teeth will often violate the biological width in the interproximal area
- ▶ The clinician must visualize that the facial aspect of the free gingival margin in periodontal health is at a similar vertical position as the interproximal osseous crest




- Some latitude exists interproximally as the gingival tissue has a slightly greater scallop than the underlying osseous crest. This anatomic difference is due to the proximal contours of adjacent teeth and their ability to support an additional height of gingival tissue in the interproximal area.
- It is important to know the total dentogingival complex measurement when preparing teeth. Assuming the normal 3 mm from the alveolar bone crest to the free gingival margin, intracrevicular margins might be located 0.5-1 mm apical to the free gingival margin or 2-2.5 mm coronal to the osseous crest.
- When the total dentogingival complex has a length of less than 3 mm, a high alveolar crest occurs and caution must be used. Margin location should be at the level of the free gingival margin or no more than 0.5 mm apically, to avoid the risk of violating the biological width.



- ▶ When the total dentogingival complex measures **more than 3 mm in height**, a low alveolar crest situation exists. The margin **may then be located greater than 1 mm apical to the free gingival margin**
- ▶ The risk in this situation is not in violating the biological width, but rather in gingival recession regardless of how “atraumatically” the tissue is managed. The relative thinness of the tissue and the amount of connective tissue attachment versus junctional epithelium are critical factors for potential gingival recession



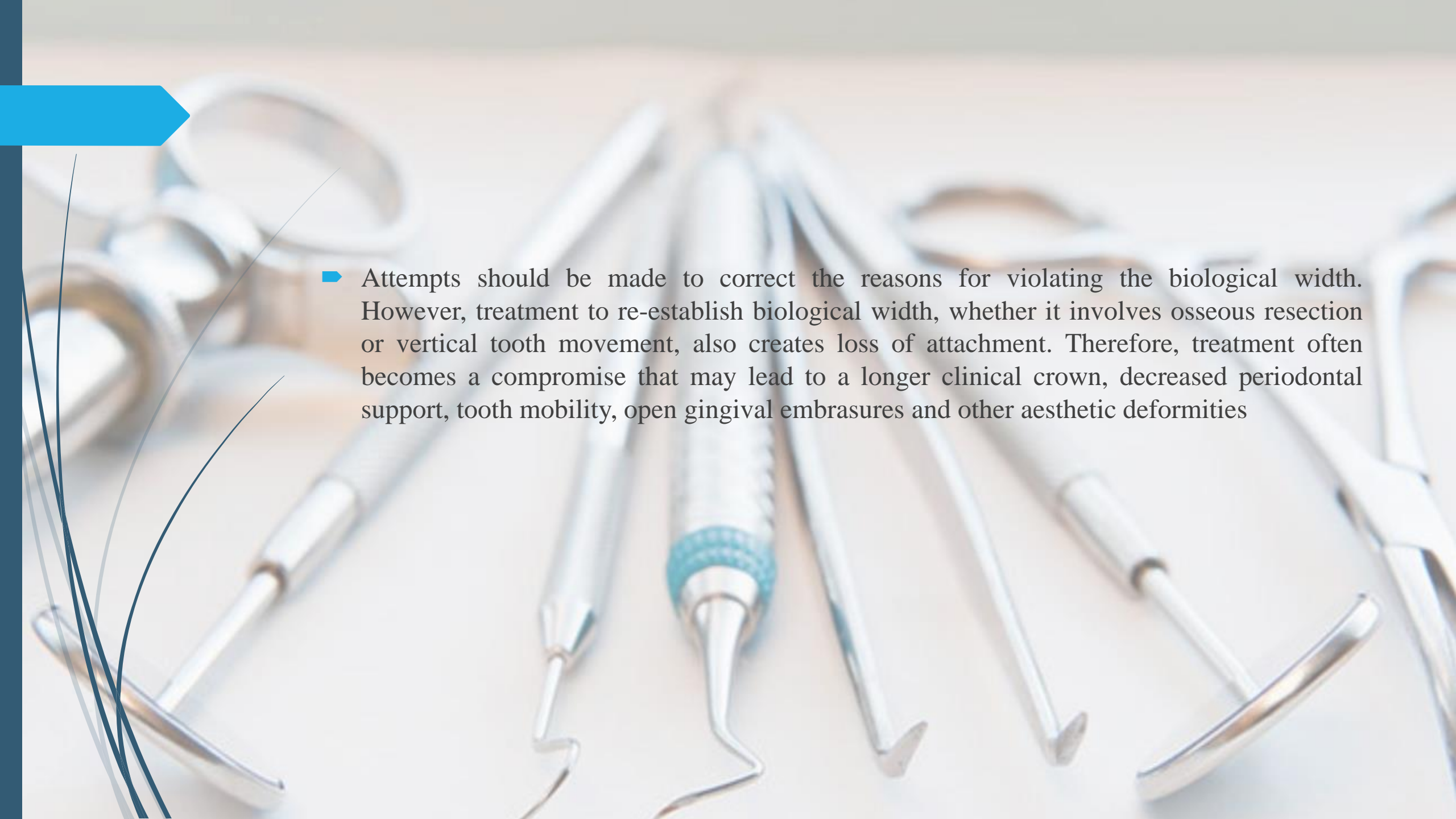
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- Overall, the tooth preparation should follow or be greater than the normal scallop of the base of the sulcus interproximally. Tissue management procedures that focus on the position of the osseous alveolar crest rather than on gingival anatomy will provide the most successful clinical outcome.

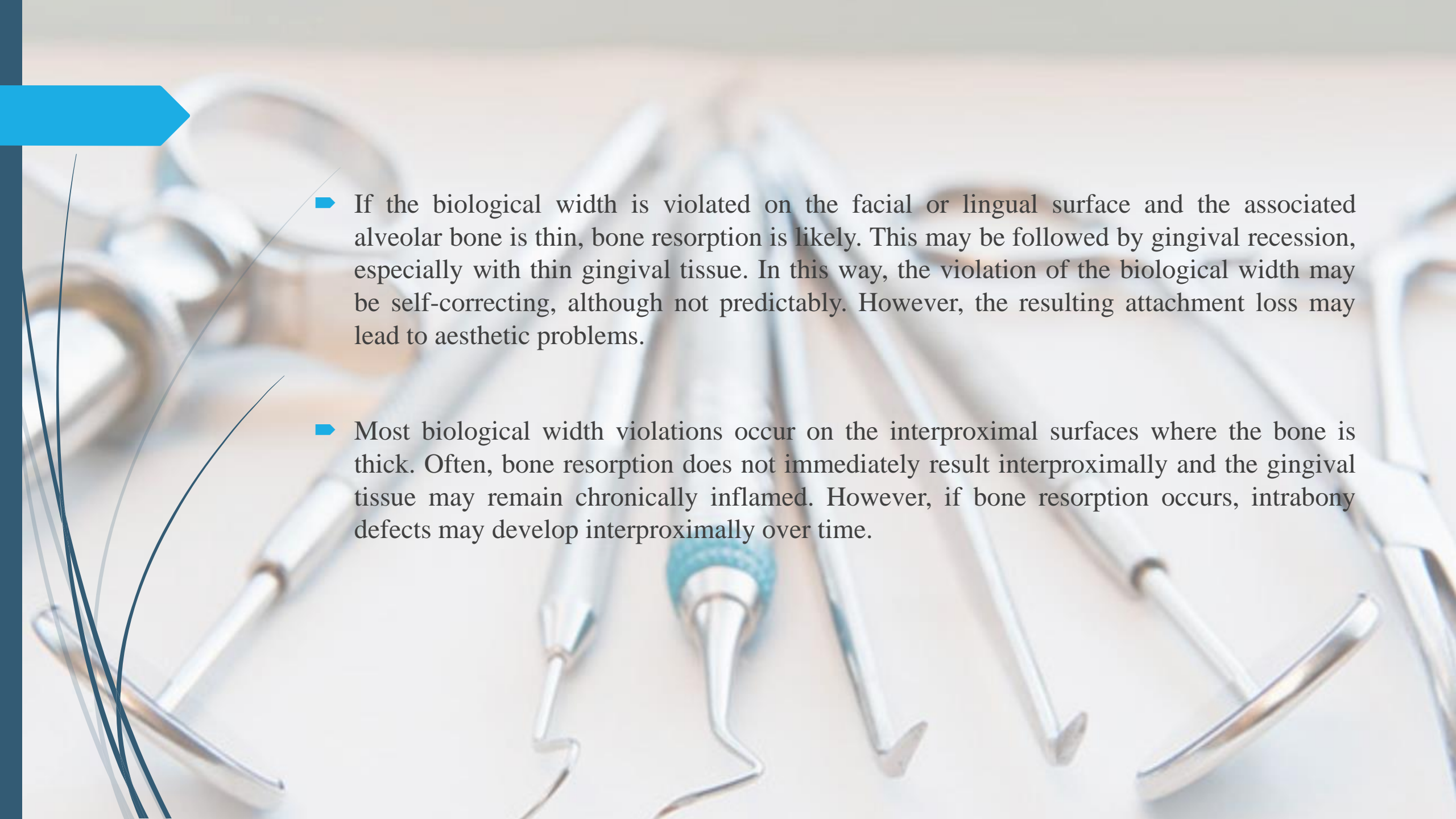


- ▶ The facial gingival changes usually start interproximally or at the line angles. Importantly, the location of a margin of a restoration relative to the crest of the alveolar bone is more critical for preserving gingival health than its distance below the free gingival margin.





- 
- A collection of various dental instruments, including probes, explorers, and scalars, are scattered on a light-colored surface. The instruments are made of polished metal, with some featuring blue or green handles. The background is slightly blurred, emphasizing the tools. A blue arrow graphic points to the right in the top left corner, and some thin, curved lines are visible on the left side of the image.
- Attempts should be made to correct the reasons for violating the biological width. However, treatment to re-establish biological width, whether it involves osseous resection or vertical tooth movement, also creates loss of attachment. Therefore, treatment often becomes a compromise that may lead to a longer clinical crown, decreased periodontal support, tooth mobility, open gingival embrasures and other aesthetic deformities

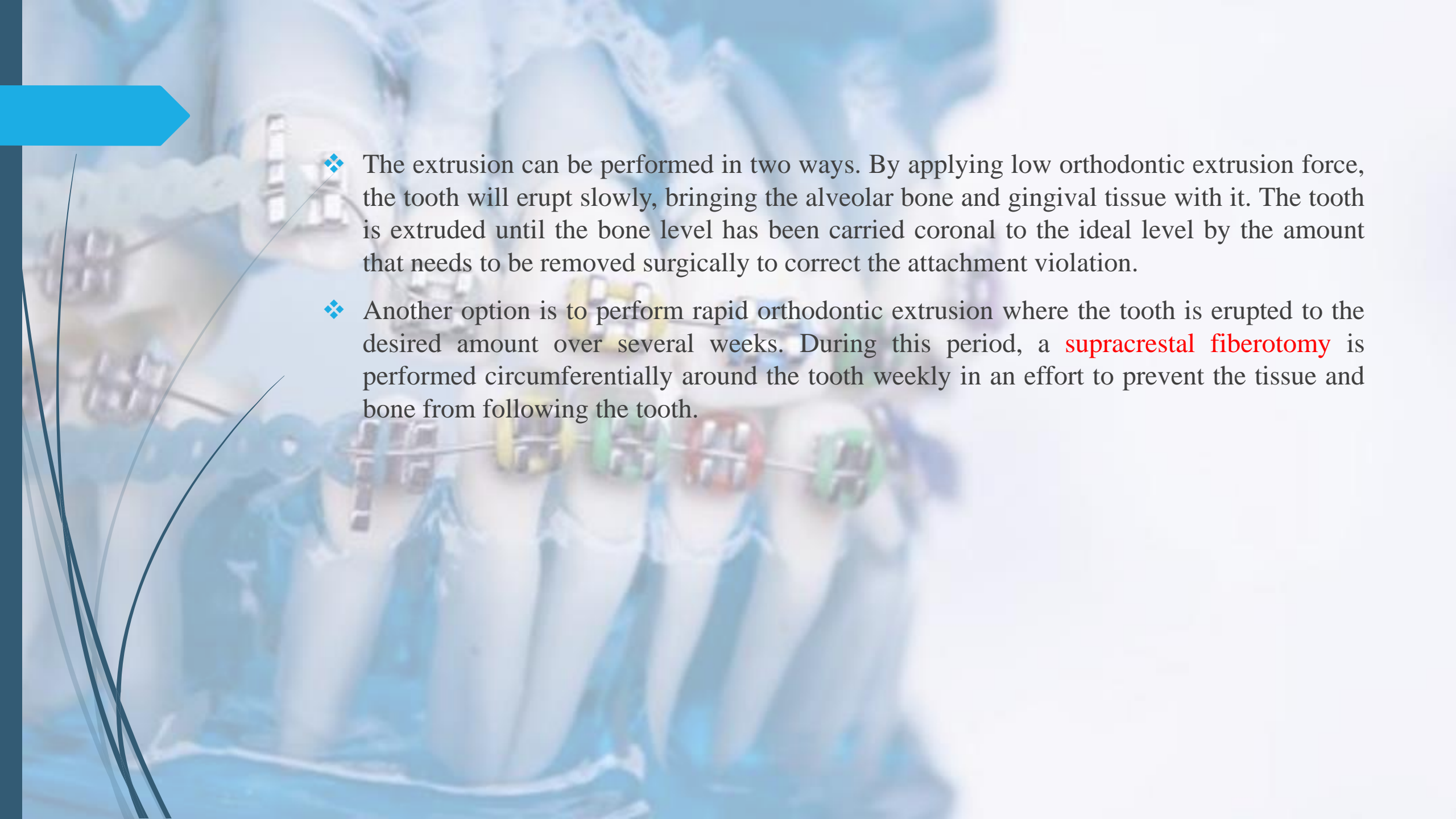
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- A collection of dental instruments, including various types of probes, explorers, and mirrors, are scattered on a white surface. The instruments are made of polished metal, with some featuring blue or green handles. The background is slightly blurred, emphasizing the tools in the foreground.
- ▶ If the biological width is violated on the facial or lingual surface and the associated alveolar bone is thin, bone resorption is likely. This may be followed by gingival recession, especially with thin gingival tissue. In this way, the violation of the biological width may be self-correcting, although not predictably. However, the resulting attachment loss may lead to aesthetic problems.
 - ▶ Most biological width violations occur on the interproximal surfaces where the bone is thick. Often, bone resorption does not immediately result interproximally and the gingival tissue may remain chronically inflamed. However, if bone resorption occurs, intrabony defects may develop interproximally over time.

Correcting Biologic Width Violations

- Surgically removing bone away from proximity to the restoration margin or by orthodontically extruding the tooth and thus moving the margin away from the bone.




- ❖ the bone should be moved away from the margin by the measured distance of the ideal biologic width for that patient, with an additional **0.5** mm of bone removed as a safety zone.

- 
- ❖ The extrusion can be performed in two ways. By applying low orthodontic extrusion force, the tooth will erupt slowly, bringing the alveolar bone and gingival tissue with it. The tooth is extruded until the bone level has been carried coronal to the ideal level by the amount that needs to be removed surgically to correct the attachment violation.
 - ❖ Another option is to perform rapid orthodontic extrusion where the tooth is erupted to the desired amount over several weeks. During this period, a **supracrestal fiberotomy** is performed circumferentially around the tooth weekly in an effort to prevent the tissue and bone from following the tooth.



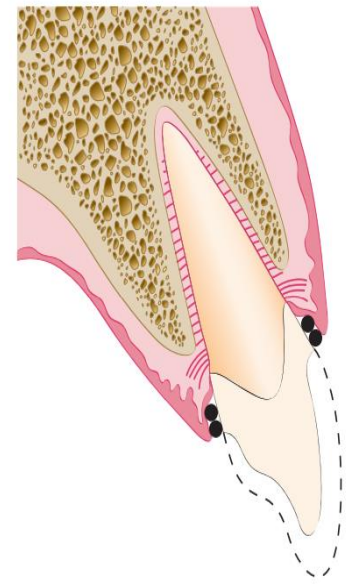
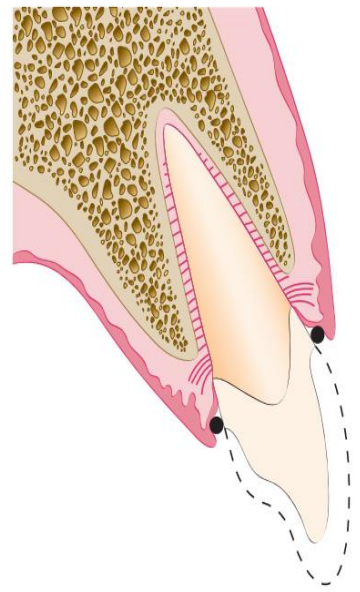
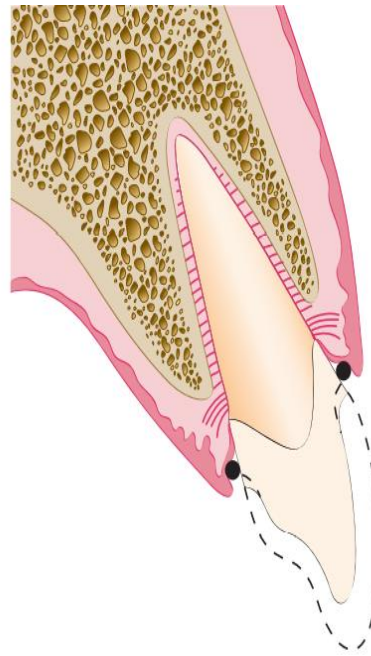
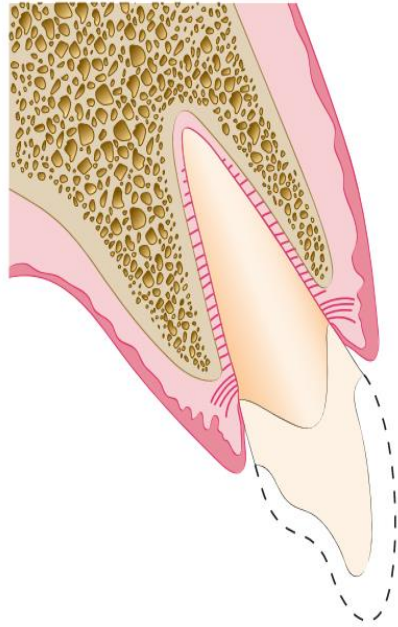
Margin Placement Guidelines

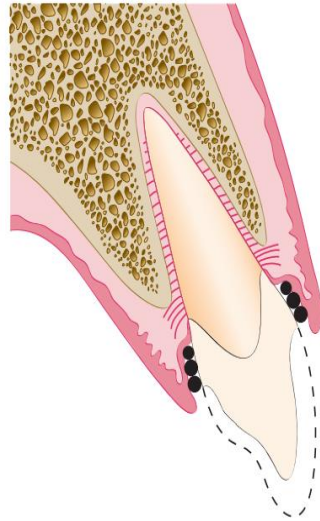
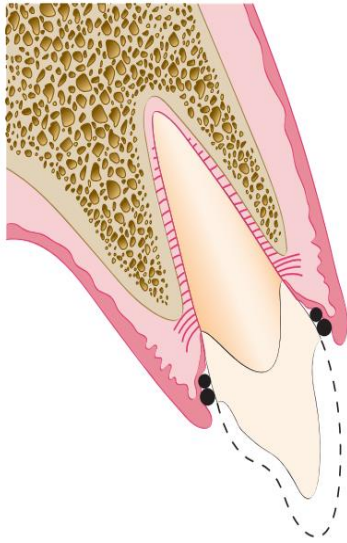
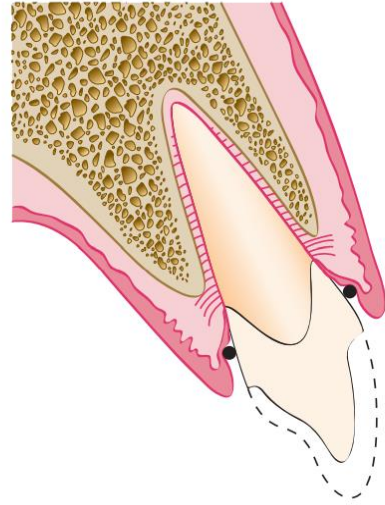
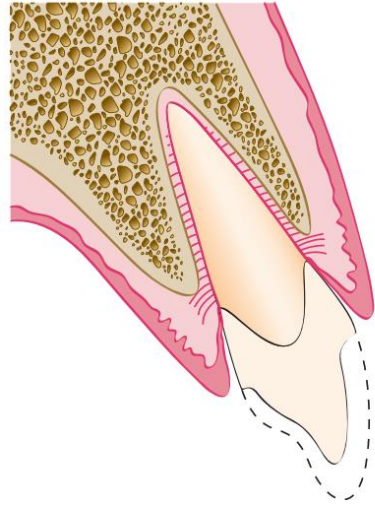
- ▶ The restorative dentist must be able to determine the base of the sulcus for intracrevicular margin location.
- ▶ The histological sulcus depth ranges from 0.5 to 1 mm, whereas the clinical sulcus depth measures from 1 to 4 mm in health.

- 
- it is recommended that the patient's existing sulcular depth be used as a guideline in assessing the biologic width requirement for that patient.
 - With shallow probing depths (1 to 1.5 mm), extending the preparation more than 0.5 mm subgingivally risks violating the attachment.
 - ❖ **Future recession is unlikely.**
 - Deeper sulcular probing depths provide more freedom in locating restoration margins farther below the gingival crest.

Clinical Procedures in Margin Placement

- **Rule 1:** If the sulcus probes 1.5 mm or less, place the restoration margin no more than 0.5 mm below the gingival tissue crest.
 - ❖ This is especially important on the facial aspect and will prevent a biologic width violation in a patient who is at high risk in that regard.
- **Rule 2:** If the sulcus probes more than 1.5 mm, place the margin no more than half the depth of the sulcus below the tissue crest. This places the margin far enough below tissue so that it will still be covered if the patient is at higher risk of recession.
- **Rule 3:** If a sulcus greater than 2 mm is found, especially on the facial aspect of the tooth, evaluate to see if a gingivectomy could be performed to lengthen the teeth and create a 1.5 mm sulcus. Then the patient can be treated using rule 1.







Thank you